

Junxiu Tang | Research Statement

My research explores the transformation of data into valuable insights, compelling narratives, and aesthetic expressions. It encompasses advanced data visualization techniques, rigorous scientific reasoning, and artistic presentation methods.

With a multidisciplinary background in architecture, digital media technology, and computer science, I integrate aesthetics, technical expertise, and research experience to tackle challenges in data understanding and communication. Through participation in diverse research projects, I have developed a strong focus on data-driven 1 insight extraction, 2 narrative development, and 3 expressive creation. I treat data as dynamic material, shaping it through computational methods and human-centered approaches to uncover patterns, communicate insights, and inspire new perspectives. By incorporating AI-assisted design and collaboration methods, I aim to enhance the creative and analytical processes, facilitating efficiency, understanding and engagement.

I collaborate with a diverse array of professionals. To uncover data insights, I gather analysis requirements from domain experts in commercial companies and government agencies. For narrative development, I conduct interviews with visualization practitioners, including designers and journalists. For creative expression, I work alongside artists from diverse backgrounds and cultures. Additionally, I visited top-tier research institutes, collaborating with senior visualization researchers, through whom I honed my expertise and deepened my appreciation for the value of research. All these collaborations offered invaluable opportunities to learn from their expertise, validate my research outputs in real-world scenarios, and reach a broad and diverse audience. They also pave the way for potential future collaborations.

My works have been published in top-tier venues such as IEEE TVCG, IEEE VIS, ACM CHI, and SIGGRAPH Art. Beyond academic contributions, the approaches I developed are applied by domain experts in practical contexts, including e-commerce warehouse order processing and transportation supervision. Additionally, my artworks have been exhibited internationally, and presented to broader audiences, narrating the stories within data. Looking ahead, my long-term goal is further to explore the fusion of scientific logic with artistic expression. I aim to combine analytical precision with creative thinking to develop practical solutions that resonate with both the mind and the heart.

Data-driven Insight Extraction: Visual Analysis on Fixed-order Event Sequence

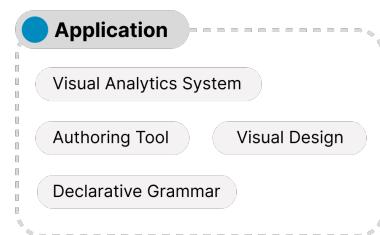
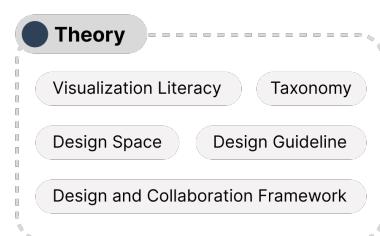
I choose sequence analysis as a testbed for extracting data insights due to the ubiquity and importance of such data in real-world applications. Fixed-order event sequences, where event order is predetermined, are common in domains like manufacturing, e-commerce, and public transportation. Visual analysis for such data aids experts in identifying patterns, detecting anomalies, and optimizing processes. However, these sequences often exhibit complex temporal, spatial, and multi-attribute structures. The lack of systematic theories and effective methods in current research leads to the research question: "How can we visualize and analyze fixed-order event sequence data?"

This question addresses three challenges: 1 evaluating visualizations and providing usage guidelines by diverse studies to identify key factors and ensure feasibility, effecti-

Research Overview



Research Keywords



veness, and generalizability across various conditions; 2 exploring complex temporal structures by addressing streaming data, multiple attributes, and dynamic inter-sequence relationships; and 3 analyzing spatial-temporal contexts by integrating spatial and temporal information in a compact and intuitive manner without overwhelming cognitive load. My research contributes both theoretical insights and practical solutions to advance fixed-order event sequence visualization and analysis.

I conducted two in-lab experiments (N=93) to **evaluate visualizations** for visualizing fixed-order event sequences [1]. The study identified experimental conclusions, practical suggestions tailored to data characteristics, and design reflections, offering actionable insights for further research and applications.

For **temporal visual analysis**, I developed innovative visualization methods, including a multi-layer drop chart for streaming data and a hybrid Gantt and stringline chart for complex temporal structures [2]. These methods are integrated into a visual analysis system designed to optimize e-commerce warehouse operations, enabling experts to monitor real-time processes, analyze historical data, and prioritize orders effectively.

For **spatial-temporal visual analysis**, I proposed a stringline-inspired visualization to merge spatial and temporal data, effectively capturing movement and stationary behaviors [3]. I further introduced a visual analysis system leveraging machine learning to support analysis in chemical transportation. This system enhances expert decision-making reliability and provides a comprehensive view of spatial-temporal dynamics.

Data-driven Narrative Development: Communication Genres

Data is everywhere. Effective narratives and communication allow individuals to read, perceive, and reflect on the data they encounter daily—whether in everyday life or at work. To improve the data-driven narrative, several research questions emerge: 1 How is data currently being communicated? 2 How can we design these data narratives more effectively to enhance viewers' understanding of data communications? 3 How can we assist in developing new data narrative strategies?

In response, I start with theoretical studies and then move towards the development and validation of practical intelligent authoring tools. My focus includes animation-based mediums such as GIFs, motion graphics, webpages, short-form videos, and standard videos. These formats are widely distributed across websites, social media, and new media platforms, reaching a diverse audience. They serve as powerful tools for making data-driven narratives more engaging.

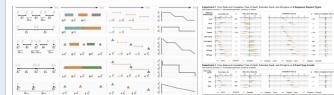
Through a content analysis of over 3,500 clips from data videos, I created a taxonomy of animated transitions that seamlessly link visualization elements with narrative content [4]. For data GIFs, I conducted user studies to identify key design factors that impact their understandability, resulting in design recommendations [5]. Additionally, I conducted user studies and designer interviews to develop design guidelines for embedding visualizations in data videos [6].

Beyond traditional, non-interactive genres, my research explores the creation of interactive data-driven content. I examined interactive storytelling formats such as scrollytelling data articles, defining their design space, and assessing user comprehension through studies [7]. I also contributed to a survey on interactive techniques for data visualization authoring tools and coordination between graphic elements [8]. My research also explores the relationship between audio channels and visualization interpretation [9]. These research outputs lay the groundwork for exploring the workflow involved in creating such interactive and multi-modal data-driven narrative communications.

This figure shows several key points of the basic and applied visualization research on fixed-order event sequence data in multiple domains (general, order processing, and transportation).

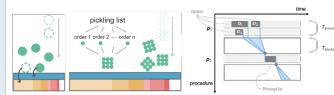
Comparative Study

Definition of diverse fixed-order event sequence data, three types of related visualizations, and partial experimental results.



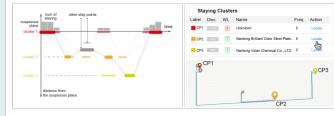
Temporal Visual Analysis

Multi-layer drop chart* for streaming data and a hybrid Gantt and stringline chart* for complex temporal structures.



Spatial-temporal Visual Analysis

A stringline-inspired visualization* to merge spatial and temporal data, effectively capturing movement and stationary behaviors.



* These visualization approaches are tailored to meet specific domain requirements but can also be extended to general use cases involving similar data structures and analytical tasks.

This figure illustrates how I conduct basic and applied visualization research across multiple genres (e.g., infographics, data videos, data GIFs, interactive tools, scrollytelling webpages, and sonifications) for data-driven communication.



Systematic Review

Corpus of Current Practice

Content Analysis

Iterative Coding & Merging

Tool/System

Design Requirements

Design Considerations

Interaction Design

Model Embedding

Iterative Development

To address the challenge of creating engaging animated data-driven content with effective visualizations, I draw on theoretical studies and investigate the considerations and workflow for such designs. I contribute to Gifify, which recommends reasonable and expressive GIFs based on input data and requirements [10]. I developed SmartShots, a system that automates the integration of visualizations into multimedia elements, allowing for post-editing flexibility [11, 12]. I also explore temporal patterns of embedded visualizations in broadcasting and enable data-driven configuration, with a specific focus on sports videos [13]. Furthermore, I propose a framework that ensures transparency in the visualization authoring process [14], to be validated in IPCC visualization publication. These contributions extend my research to more dynamic and complex contexts.

In addition to authoring, I also develop advanced tools to help improve visualization literacy education [15], analyze uncertainty [16], and diagnose data flaws [17]. All these efforts enhance the accessibility and engagement of data communication through innovative visualization and interaction techniques.

Data-driven Expressive Creation: Art Practice

"In a world where paths diverge, scientists and artists find ways to converge, bringing people together." My art practice spans a diverse range of topics and employs various techniques and presentations. While aesthetic appeal is a central focus, my work is deeply rooted in scientific principles, blending artistic expression with data-driven insights to create emotionally engaging experiences for audiences. Some of my artworks have been exhibited at venues such as SIGGRAPH Art, IEEE VISAP, and the Info+ Conference, and China VISAP. Beyond creating art, I also co-organized a panel [18] at IEEE VIS 2024, contributing to the dialogue between art, science, and data visualization.

My artworks span the spectrum between art and visualization, bridging the abstract and emotional qualities of artistic expression with the analytical depth of visual storytelling.

On the art-focused end of the spectrum, *Loss of Sonnet 18* examines the essence of information communication and the eternal losses in its transmission [19]. Using technical displays as a medium, it explores philosophical aspects behind these processes.

Similarly, *The Island of Loneliness* expresses art through data physicalization. Using the metaphor of the sea and an island, it translates the often-overlooked voices on social media into a visual form, enabling audiences to explore themes of loneliness and isolation in a way that blends emotional resonance with analytical clarity [20].

Moving toward the visualization end, *Life Thread* celebrates the diversity of individual life paths while challenging societal expectations and stereotypes [21]. Data plays a central role in this work, acting as a storyteller of unique personal journeys.

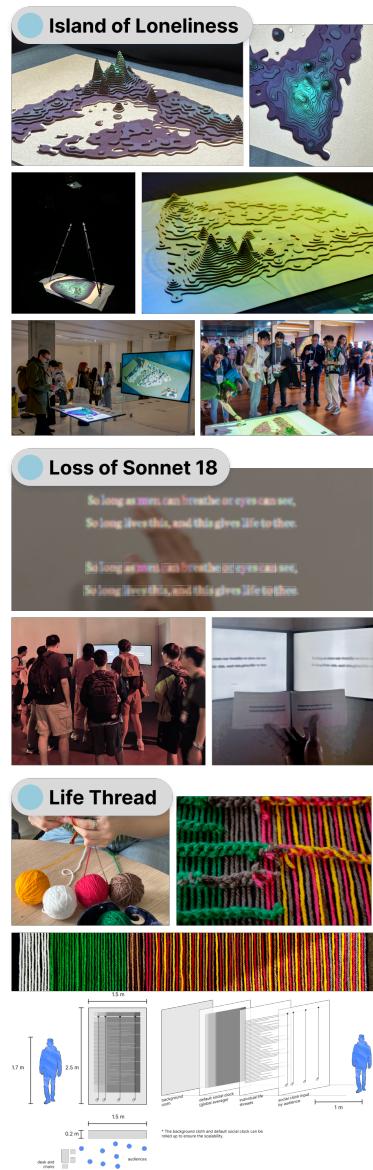
Anchored by visual analysis principles, I collected and labeled data, reflected on the connections between past and present, and developed a deeper appreciation for the abstract themes and subjective emotions in Chinese classical poetry [22].

These projects showcase the intersection of data visualization and art, expressing the messages generated by data patterns. My artworks invite the audience into a journey of discovery and immerse themselves in the fascinating world where data and art converge.

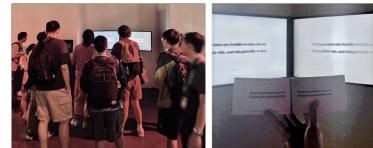
AI-assisted Design and Collaboration

With the integration of AI, my research advances creative design and interdisciplinary collaboration. I proposed a non-linear framework for creative design that emphasizes the value of remixing in human-AI co-design processes [23]. Additionally, I developed methods to simplify the creation of coordinated interactions in visual analysis systems

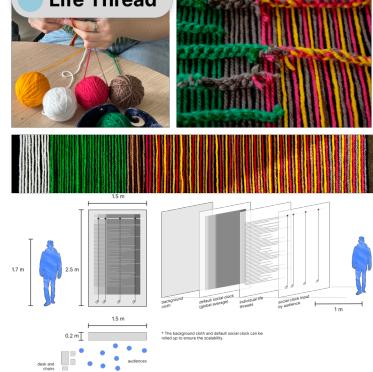
Art Practice



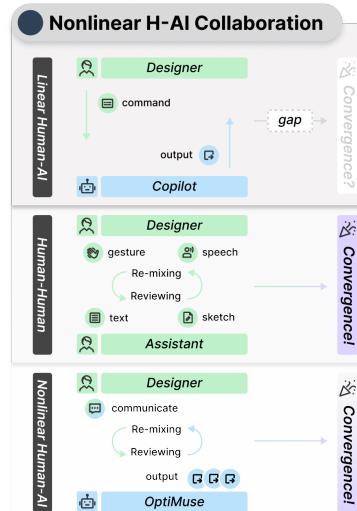
Loss of Sonnet 18



Life Thread



AI-assisted Design and Collaboration



using natural language inputs [24]. Furthermore, my work facilitates collaboration among individuals from diverse backgrounds by leveraging AI-assisted tools and methodologies [25]. These efforts collectively showcase how AI can serve as a transformative force in both creative and collaborative practices.

Future Research Agenda

In the future, my work will continue to explore the fusion of scientific logic and artistic expression, aiming to bridge analytical rigor with creative insight.

Exploring Career Paths through Data-driven Insights and Expressions. Building on my research into fixed-order event sequences, I plan to extend this work by exploring new domains, particularly career/life paths, where the order of events plays a crucial role in understanding individual trajectories and societal patterns. Career/life paths, to some degree, as a form of fixed-order event sequence data, offer valuable insights into how individuals navigate various stages of their professional/personal lives, revealing patterns and trends and serving as a reference point for inspiration and reflection. By developing specialized visualization and analysis methods, I aim to uncover deeper insights that can guide strategic career planning, inform organizational decision-making, and help individuals navigate their professional journeys more effectively.

This topic also ties closely to one of my ongoing projects, *Life Thread* [21], which explores the concept of the social clock. This project illustrates how individual life paths may diverge from societal stereotypes yet remain subtly anchored to them. A key area of my interest is examining career paths across different genders, domains, regions, and timeframes, particularly in light of my own experiences and reflections during the job search process. In this context, I am eager to understand what constitutes the "best" life choices, a question that perhaps can only be answered by a combination of scientific analysis and artistic reflection.

Extending Data-driven Communication to Diverse Displays and Modalities. I aim to broaden the scope of data-driven communication by exploring visualizations across a wider range of display types and modalities. This includes adapting visualizations for small screens, wearable devices, and unconventional display forms with varying sizes, styles, and shapes. Additionally, I will investigate alternative channels such as sonification and physical/tangible interfaces, integrating these with visualizations to enhance engagement, improve accessibility, and cater to diverse audiences.

Exploring New Paradigms of AI-assisted Data-driven Creative Design. With the rapid advancement of generative AI models, I aim to further model collaborative processes among humans and extend these to human-AI collaboration. This research will explore innovative ways AI can enhance creativity, streamline workflows, and support data-driven design across disciplines.

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